

What is claimed is:

1. An LED lamp comprising:

an LED chip having a top light-emitting face, said chip including a translucent substrate at least part of which has a refractive index n_b and a light guide core on said substrate part comprising LED semiconductor layers having a refractive index n_g that is at least 20% greater than n_b , said LED semiconductor layers having an active region;

a plurality of cavities each forming in a portion of said core spaced-apart light emitting elements each having at least one side wall;

a reflective interface between said core and said substrate which is light-passing to light of low angles of incidence;

at least one opaque reflector the plane of which is parallel to said top face positioned to reflect rays of guided light that have been diverted by a said side wall; and

electrical connection for energising a plurality of said elements in unison.

2. An LED lamp according to claim 1 wherein said cavities are trenches.

3. An LED lamp according to claim 1 wherein said lamp converts guided light in said core into top light passing through said top face.

4. An LED lamp according to claim 1 including an opaque reflector that provides double reflection of light from a said wall.

5. An LED lamp according to claim 1 including a heat sink joined to said substrate;

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6. An LED lamp according to claim 1 wherein said cavity includes a side wall forming an angle with said top face exceeding 95 degrees.

7. An LED lamp according to claim 1 wherein the width of the top face of each of said light emitting elements is greater than the width K of said cavity.

8. An LED lamp according to claim 2 wherein each trench includes an opaque reflector extending along a substantial part of the length of the trench.

9. An LED lamp according to claim 8 wherein said opaque reflector is metallic and passes at least some of the operating current of a said light emitting element.

10. An LED lamp according to claim 2 wherein a substantial part of a said wall includes an opaque reflector.

11. An LED lamp according to claim 1 wherein said cavity is filled with translucent material having a refractive index that is greater than one and that is at least 20% less than the refractive index n_s of said semiconductor layers.

12. An LED lamp according to claim 1 wherein said cavity extends into said core by less than 95% of the total thickness of the core.

13. An LED lamp according to claim 1 wherein said cavity extends into said core by more than 50% of the total thickness of the core.

14. An LED lamp according to claim 1 having a plurality of light emitting elements each having a polygonal-shaped top face that has two sides that are inclined one to the other by an acute angle, said chip including trenches between said elements with polygonal top faces, each trench having at least one light-emitting side wall,

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15. An LED lamp according to claim 1 comprising light emitting elements having triangular-shaped top faces.

16. An LED lamp according to claim 1 including a plurality of light emitting elements each provided with an individual fuse.

17. An LED lamp according to claim 1 wherein said chip includes first and second LED elements and metallic connection connecting the anode of the first LED element to the cathode of the second LED element.

18. An LED lamp according to claim 1 wherein said chip includes first and second LED elements and metallic connection between the cathodes of the LED elements.

19. An LED lamp comprising:

an LED chip having a top light-emitting face, said chip including a translucent substrate at least part of which has a refractive index n_b , and a light guide core on said substrate part comprising LED semiconductor layers having a refractive index n_s that is at least 20% greater than n_b , said LED semiconductor layers having an active region;

a plurality of cavities each forming in a portion of said core spaced-apart light emitting elements each having at least one side wall

a heat sink having a reflective face;

a translucent substance having a refractive index n_c that is less than the refractive index n_b of said semiconductor layers and greater than one placed between said top face and said heat sink reflective face; and

electrical connection for energising a plurality of said elements in unison.

20. An LED lamp according to claim 19 including spacers of

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material of higher thermal conductivity than said translucent substance passing heat from said chip to said heat sink.

21. An LED lamp according to claim 19 including a translucent medium of different material from said semiconductor layers covering at least part of said side wall;

22. An LED lamp according to claim 19 wherein said cavities are trenches.

23. An LED lamp according to claim 19 wherein said cavity includes a side wall forming an angle with said top face exceeding 95 degrees.

24. An LED lamp according to claim 19 wherein the width of the top face of each of said light emitting elements is greater than the width K of said cavity.

25. An LED lamp according to claim 22 wherein each trench includes an opaque reflector extending along a substantial part of the length of the trench.

26. An LED lamp according to claim 25 wherein said opaque reflector is metallic and passes at least some of the operating current of a said light emitting element.

27. An LED lamp according to claim 22 wherein a substantial part of a said wall includes an opaque reflector.

28. An LED lamp according to claim 19 wherein said cavity is filled with translucent material having a refractive index that is greater than one and that is at least 20% less than the refractive index n_s of said semiconductor layers.

29. An LED lamp according to claim 19 wherein said cavity extends into said core by less than 95% of the total thickness of the core.

30. An LED lamp according to claim 19 wherein said cavity extends into said core by more than 50% of the total thickness

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of the core.

31. An LED lamp according to claim 19 having a plurality of light emitting elements each having a polygonal-shaped top face that has two sides that are inclined one to the other by an acute angle, said chip including trenches between said elements with polygonal top faces, each trench having at least one light-emitting side wall,

32. An LED lamp according to claim 19 comprising light emitting elements having triangular-shaped top faces.

33. An LED lamp according to claim 19 including a plurality of light emitting elements each provided with an individual fuse.

34. An LED lamp according to claim 19 wherein said chip includes first and second LED elements and metallic connection connecting the anode of the first LED element to the cathode of the second LED element.

35. An LED lamp according to claim 19 wherein said chip includes first and second LED elements and metallic connection between the cathodes of the LED elements.

36. An LED lamp comprising:

an LED chip having a top face, said chip including a substrate at least part of which is translucent and has a refractive index n_b and a light guide core on said substrate part comprising LED semiconductor layers having a refractive index n_s that is at least 20% greater than n_b , said LED semiconductor layers having an active region;

a plurality of cavities each forming in a portion of said core spaced-apart light emitting elements at least one of which has light emitting side walls and a polygonal-shaped top face that has two sides that are inclined one to the other by an acute angle; and

electrical connection for energising a plurality of said light emitting elements in unison.

37. An LED lamp comprising:

an LED chip having a top face, said chip including a substrate at least part of which is translucent and has a refractive index n_b and a light guide core on said substrate part comprising LED semiconductor layers having a refractive index n_s that is at least 20% greater than n_b , said LED semiconductor layers having an active region;

a plurality of cavities each forming in a portion of said core spaced-apart light emitting elements each having at least one side wall; and

electrical connections for energising a plurality of said light-emitting elements in unison, said electrical connections including fuses.

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